

# **THE EFFECTS OF SPACEFLIGHT AND A SPACEFLIGHT ANALOG ON NEUROCOGNITIVE PERFORMANCE: EXTENT, LONGEVITY, AND NEURAL BASES**

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## **Abstract**

We are conducting ongoing experiments in which we are performing structural and functional magnetic resonance brain imaging to identify the relationships between changes in neurocognitive function and neural structural alterations following a six month International Space Station mission and following 70 days exposure to a spaceflight analog, head down tilt bedrest. Our central hypothesis is that measures of brain structure, function, and network integrity will change from pre to post intervention (spaceflight, bedrest). Moreover, we predict that these changes will correlate with indices of cognitive, sensory, and motor function in a neuroanatomically selective fashion. Our interdisciplinary approach utilizes cutting edge neuroimaging techniques and a broad ranging battery of sensory, motor, and cognitive assessments that will be conducted pre flight, during flight, and post flight to investigate potential neuroplastic and maladaptive brain changes in crewmembers following long-duration spaceflight. Success in this endeavor would 1) result in identification of the underlying neural mechanisms and operational risks of spaceflight-induced changes in behavior, and 2) identify whether a return to normative behavioral function following re-adaptation to Earth's gravitational environment is associated with a restitution of brain structure and function or instead is supported by substitution with compensatory brain processes. With the bedrest study, we will be able to determine the neural and neurocognitive effects of extended duration unloading, reduced sensory inputs, and increased cephalic fluid distribution. This will enable us to parse out the multiple mechanisms contributing to any spaceflight-induced neural structural and behavioral changes that we observe in the flight study. In this presentation I will discuss preliminary results from six participants who have undergone the bed rest protocol. These individuals show decrements in balance and functional mobility, and alterations in brain structure and function, in association with extended bed rest.

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